Photonics and optical communication

"Photonics is the optical equivalent of light. Photonic systems use light, instead of electricity, to process, store, and transmit energy. Photonics is a pervasive technology, which is capable of significantly influencing communications and information systems worldwide" [1].

The author of that *Tech Trend Notes* article eagerly anticipated new photonic systems and devices that would increase network capacity and secure the optical communications flowing over those networks. Indeed, photonics in the form of fiber-optic technology helped enable the expansion of the early Internet from a support service for scientific researchers to a worldwide communications network [2].

Securing the data, however, has been an ongoing struggle. Traditional encryption is based in part on mathematical problems, such as factoring extremely large numbers. But as computers became more powerful, concern increased about their ability to break traditional cryptographic codes, and researchers looked for alternative ways to protect transmitted data.

Quantum cryptography, which depends on principles of quantum physics instead of mathematical problems, has become the holy grail of protection.

The theory of quantum cryptography was originally proposed in 1982, the technology and protocol were first demonstrated experimentally in 1989 [3], and the first commercial quantum cryptography technology in the US was installed in 2012 [4]. As with many theories, commercial development of quantum cryptography had to wait for the supporting technologies. (Even the scientists who propounded the theory of quantum cryptography in 1982 thought of it as science fiction because the technology required to implement it was out reach at the time [3].)

One of those supporting technologies, single-photon detectors, is discussed in the following article both as a key technology for quantum cryptography as well as for other methods of communication in extreme conditions.